Local Anesthetic Systemic Toxicity Simulation Survey: A Resident Experience

INDIANA UNIVERSITY SCHOOL OF MEDICINE

Zachary J. Schell, BS, Sally A. Mitchell, MMSc, EdD, Tanna J. Boyer, DO, MS

Department of Anesthesia, Indiana University School of Medicine and Riley Hospital for Children, Indianapolis, Indiana

BACKGROUND

Local anesthetic systemic toxicity (LAST) is a rare, life-threatening complication associated with regional nerve blocks. Early diagnosis with effective management is essential to improve patient outcomes. Simulation scenarios can help prepare residents to handle complex scenarios such as LAST. Simulation surveys can assess post-simulation learning and simulation effectiveness. These surveys can also identify areas for simulation improvement. Survey results are often negatively impacted by survey fatigue and non-response.

OBJECTIVE

Our goal was to develop a post-simulation survey that minimizes non-response rate and survey fatigue while assessing post-simulation learning and effective simulation teaching.

METHODS

CA2 Anesthesia residents completed a simulation involving a 2-year-old patient who develops LAST during a hypospadias repair. Survey objectives were created in conjunction with simulation objectives. Survey questions were then carefully crafted according to established survey design principles and survey objectives. Additional editing was performed to ensure objective focused questions while also maximizing survey completion.

SIMULATION OBJECTIVES

1. Diagnose LAST under general anesthetic
2. Manage a pediatric patient with LAST
3. Utilize effective communication and crisis resource management skills during a case with local anesthetic toxicity
4. Perform a comprehensive handoff
5. Describe the utility of checklists as a cognitive aid and use a cognitive aid during a case with local anesthetic toxicity

SURVEY OBJECTIVES

1. Assess post-simulation learning of diagnostic and therapeutic LAST principles
2. Determine utility of checklists during LAST scenario
3. Evaluate anesthesia faculty/staff intra-simulation teaching

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CHECKLIST FOR TREATMENT OF LOCAL ANESTHETIC SYSTEMIC TOXICITY (LAST)

The Pharmacologic Treatment of LAST is Different from Other Cardiac Arrest Scenarios

- **Reduce** individual **epinephrine** boluses to ≤ 1 mcg/kg
- **Avoid** vasopressin, calcium channel blockers, beta blockers, or other local anesthetics

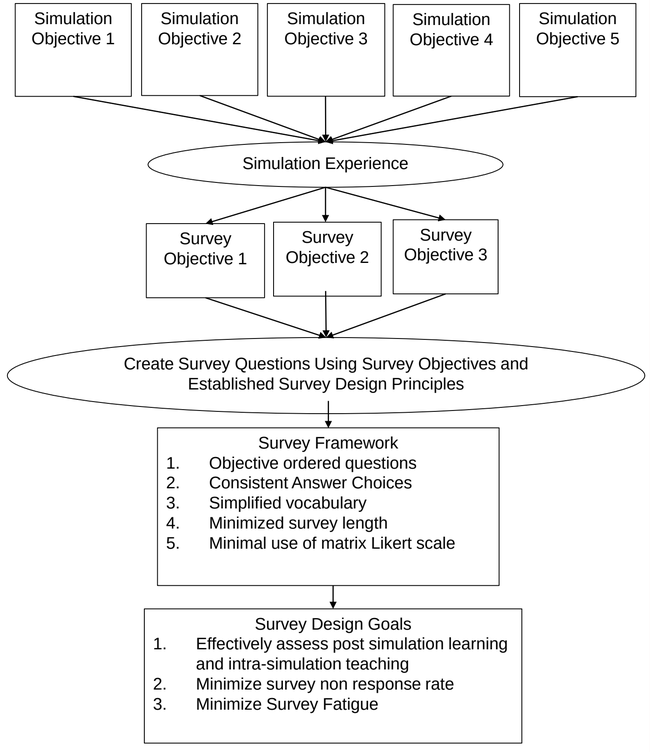
- Stop injecting local anesthetic
- Get help
  - Consider lipid emulsion therapy at the first sign of a serious LAST event
  - Call for the LAST Rescue Kit
  - Alert the nearest cardiopulmonary bypass team - resuscitation may be prolonged
- Airway management
  - Ventilate with 100% oxygen / avoid hyperventilation / advanced airway device if necessary
- Control seizures
  - Benzodiazepines preferred
  - **Avoid** large doses of **propofol**, especially in hemodynamically unstable patients
- Treat hypotension and bradycardia **– If pulseless, start CPR**

Lipid Emulsion 20% (Precise volume and flow rate are not crucial)	
Greater than 70 kg patient	Less than 70 kg patient
Bolus 100 mL Lipid Emulsion 20% rapidly over 2-3 minutes • Lipid emulsion infusion 200-250 mL over 15-20 minutes	**Bolus 1.5 mL/kg Lipid Emulsion 20%** rapidly over 2-3 minutes • Lipid emulsion infusion ~0.25 mL/kg/min (ideal body weight)
If patient remains unstable: • Re-bolus once or twice at the same dose and double infusion rate; be aware of dosing limit (12mL/kg) • Total volume of lipid emulsion can approach 1 L in a prolonged resuscitation (e.g., > 30 minutes)	

- Continue monitoring
  - At least 4-6 hours after a cardiovascular event
  - Or, at least 2 hours after a limited CNS event
- Do not exceed 12 mL/kg lipid emulsion (particularly important in the small adult or child)
  - Much smaller doses are typically needed for LAST treatment
- See reverse side of this checklist for further details

RESULTS

Questions were ordered according to survey objectives to create a logical flow. When feasible answer choices were kept constant, vocabulary was simplified, and survey length was reduced to minimize survey fatigue. Matrix style Likert questions were substituted with multiple choice questions to minimize nonresponse rate.



CONCLUSIONS

By employing established survey design principles with objective structured questions, we developed a framework to improve survey quality. This will help to decrease non-response rates while effectively assessing post-simulation learning and intra-simulation teaching. We will use the results to determine curricular changes, scenario changes, and simulation faculty education that will improve anesthesia resident learning.

REFERENCES

1. Jones T, Baxter M, Khanduja V. A quick guide to survey research. The Annals of The Royal College of Surgeons of England. 2013;95(1):5–7.
2. Liu M, Cernat A. Item-by-item Versus Matrix Questions. Social Science Computer Review. 2016;36(6):690–706.
3. Neal JM, Woodward CM, Harrison TK. The American Society of Regional Anesthesia and Pain Medicine Checklist for Managing Local Anesthetic Systemic Toxicity. Regional Anesthesia and Pain Medicine. 2018Feb;43(2):150–3.
4. OECD (2012), "Good Practices in Survey Design Step-by-Step", in Measuring Regulatory Performance: A Practitioner's Guide to Perception Surveys, OECD Publishing, Paris.